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ABSTRACT

A study was conducted to determine what occupations nationally are new and changing and if they need curriculum development at the vocational education level. The process used to conduct this study involved four steps: identifying new and changing occupations, collecting information about the occupations, locating available instructional materials, and assessing the need for curriculum development. Fifteen occupations were identified as either new or changing a great deal. Occupations that need curriculum development because very little if any instructional materials exist are catfish farm manager, computer drafting/graphics technician, and speech-language hearing assistant. Occupations that have a partial need for curriculum development (portions of curricula may be available or a recombining of existing curricula may be needed) are cable television technician and aviation maintenance technician. Occupations that need to be observed closely because of their potential importance in the future include neurometrics technician, electromyography technician, hydroponic agriculture specialist, fiber optics technician, and personnel and labor relations specialist. Occupations that are changing and that may or may not have adequate curricula, but for which schools seem to need help in implementing programs, are locksmith, word processing specialist, and welder. (LRA)

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IMPLICATIONS OF NEW AND CHANGING OCCUPATIONS FOR INSTRUCTIONAL DEVELOPMENT

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NATIONAL INSTITUTE OF EDUCATION

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FOREWORD

The labor market is changing, and vocational educators must be aware of those changes as they prepare and retrain the nation's workers. New and changing jobs and technologies require skilled personnel to produce goods and services effectively. The National Center, under contact with the Office of Vocational and Adult Education, U. S. Department of Education, has been developing information about changing occupations to help planners and curriculum developers to meet the needs in these areas.

This report provides descriptions of a number of occupations that have been identified as either new or changing, are national in scope, and are appropriate within the realm of vocational education. It highlights the need for curriculum development and the methodology for conducting the research is outlined.

Jill Frymier Russell had the major responsibility for assembling the information and preparing this report with the assistance of Mollie Orth, Paulette Robinson, and Fidelia Chukwuma, and the typing services of Kathie Medley and Rusty Grohoske. Morgan Lewis served as project director.

Numerous individuals throughout the country and in various industries were very helpful in providing information about occupations and training opportunities. Eight individuals in particular examined drafts of occupational descriptions, verified the contents, and supplied additional information. They are as follows: Charles Kao, International Telephone and Telegraph; Lynn Faulkner, Battelle Memorial Institute; John Manning, Columbus Technical Institute; Robert Thatcher, University of Maryland Eastern Shore; Wayne Shell, Auburn University; Frank Treuman, New York School of Locksmithing; Peggy Williams, the American Speech-Hearing Language Association; and Conni Taylor, Nationwide Insurance Company.

The three persons who reviewed the document prior to publication were Ron Denison of the National Center; Andy Korim of West Virginia State College; and Joyce Kinnison of the South Carolina Occupational Information Coordinating Committee. Their input was most useful.

Robert E. Taylor
Executive Director
The National Center
for Research in
Vocational Education

EXECUTIVE SUMMARY

This report describes a study of new and changing occcupations for which curricular materials may be lacking. Vocational education planners need to know how the labor market is changing so they may modify their programs to meet those changes. In some cases a curriculum development effort will be needed. Other times, changes in an occupation will necessitate modifying or combining existing curricula. By examining both labor market changes and curriculum availability, this study has identified curriculum development priorities within vocational education.

The process used to conduct this study involves four steps: identifying new and changing occupations; collecting information about the occupations; locating available instructional materials; and assessing the need for curriculum development.

Fifteen occupations and their need for curriculum are reported in this document. The occupations present varying degrees of newness and some are not new at all but are changing a great deal. The degree to which curriculum is available varies also. Some of the occupations are quite new but have adequate curricula; others may have existed for twenty years, but new growth requires that more formalized training be instituted.

Occupations that need curriculum development because very little if any instructional materials exist are: catfish farm manager; computer drafting/graphics technician; and speech-language hearing assistant.

Occupations that have a partial need for curriculum development (portions of curricula may be available or a re-combining of existing curricula may be needed) are: cable television technician; and aviation maintenance technician.

Occupations that need to be observed closely because of their potential importance in the future include: neurometrics technician; electromyography technician; hydroponic agriculture specialist; fiber optics technician; and personnel and labor relations specialist.

An occupation that is new but which appears to have adequate curricula is that of perfusionist.

Occupations that are changing and that may or may not have adequate curricula, but for which schools seem to need help in implementing programs are: locksmith; word processing specialist; and welder.

CHAPTER 1

INTRODUCTION

There are many reasons why it is necessary for vocational education professionals to remain abreast of information concerning the progress of emerging and changing occupations. First, since the purposes of vocational education are to prepare persons for employment and to meet employers needs for trained personnel, it is logical that vocational educators must attend to changes in the labor market. To fulfill their function, vocational educators must make adaptations in program offerings and curriculum as variations in the labor market occur. Second, the federal legislation (P.L. No. 94-482) which contributes to the funding of vocational education programs mandates that priority be given to program development for new and emerging occupations (U.S. Congress, 1976). The policymakers for the nation have thus determined that responsiveness to new or expanding occupational needs is an important aspect of vocational education.

A third reason why it is necessary to be quickly aware of changes in employment patterns is that program development processes can take several years (Nickerson 1978). Unless vocational educators are regularly watching for changes, a lag time can occur between when employers need trained personnel and when vocational education institutions graduate prepared students. Fourth, if vocational education does not respond to major labor market fluctuations, it could come to be serving an increasingly narrow scope of occupations. For example, if vocational education had not added programs in the 1960s and 1970s on computer and health technologies, another type of training provider might have prepared to meet that need, and students interested in those fields would have been lost to vocational education.

The mutually beneficial reasons for studying and responding to results about new and emerging occupations were summarized by Dr. Ann Martin at a conference on occupational education in the future and the impact of technology.

> In an age of rapid technological change it is essential to develop methods of projecting work force needs and work force data on a one, three, five year planning basis. This would benefit business and industry by giving them a better pool of job applicants. It would benefit the school system by enabling it to attune its curriculum to the needs of the market place; and it would benefit individuals by providing them a chance to prepare for the job opportunities available. (U.S. Office of Education 1979)

In an effort to be responsive to all the reasons for maintaining knowledge about new occupational developments, the U.S. Office of Vocational and Adult Education commissioned the study reported in this document. The study was designed specifically to be useful to national policymakers who plan for vocational education.

Parameters of the Study

The purpose of this document is to present the findings from research that identified and analyzed new and changing occupations and assessed the need for curriculum development. All of the occupations examined are national in scope and require less than a baccalaureate degree as preparation for entry. This report delineates the results from the third year of an annually repeated project. For two preceding years new and changing occupations were also studied, but are not presented herein (Forgione and Kopp 1979) (Orth and Russell 1980). Refer to these earlier editions for additional descriptions of new and changing occupations.

The definition for new and changing occupations used for this study is: career fields in which there is "national demand, that have become identifiable in the past decade, and that have developed as a result of--

a. the creation of new industries or occupations (for example, the computer industry),

b. a significant restructuring of existing occupations (for example, physician's assistant), or

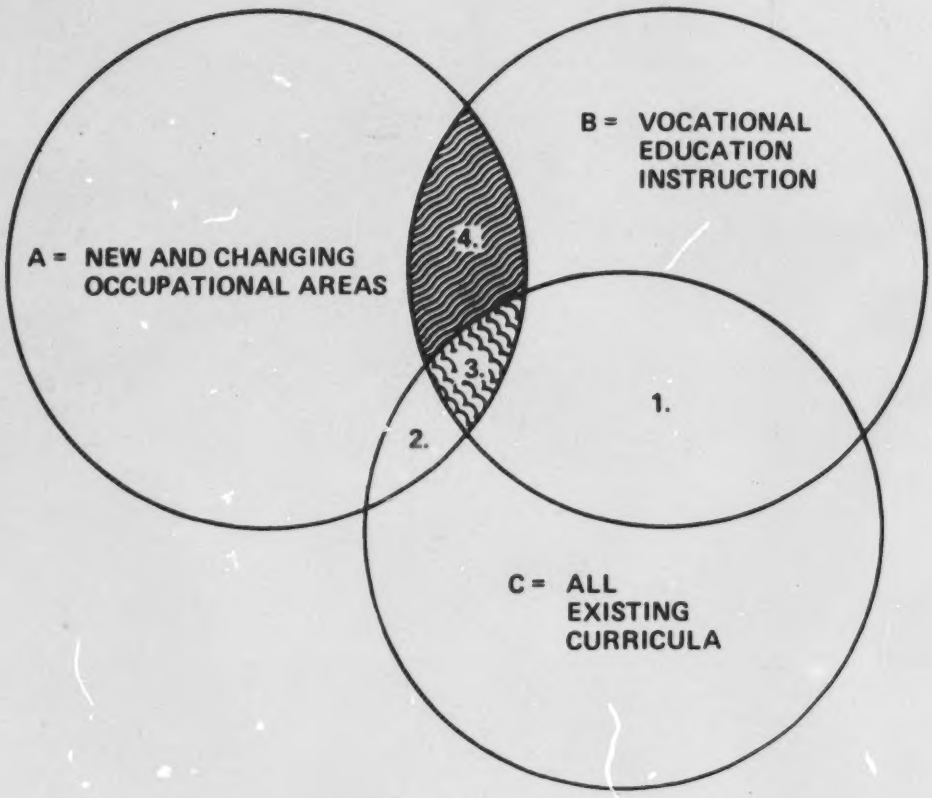
c. modification of required skills in existing occupations (for example, word processing)" (Forgione and Kopp 1979).

Figure 1.1, entitled "Identifying Needs for Curriculum Development in Vocational Education for New and Changing Occupational Areas," portrays the scope of the research for this project.

"Curriculum" is a term which may have varying interpretations for different people. To know whether or not adequate curriculum is available, one must have a concept of what curriculum means. Curriculum was defined for this study as "those materials which delineate learning objectives, topical outline, content, and methodology of a formal instructional course or series of courses. The materials, whether written or audiovisual, must be organized so that they can be transported, i.e., adopted or adapted for use by others" (Orth and Russell 1980).

Figure 1.1

Identifying Needs for Curriculum Development in Vocational Education for New and Changing Occupational Areas



Key

1. Existing curricula for established occupational areas that fall within the scope of vocational education instruction.

2. Existing curricula for new and changing occupational areas that do *not* fall within the scope of vocational education instruction.

3. Existing curricula for new and changing occupational areas that fall within the scope of vocational education instruction.

4. New and changing occupational areas that fall within the scope of vocational education instruction but for which *no adequate curricula exist.*

Process

In order to determine what occupations nationally are new and changing and if they need curriculum development at the vocational education level, a four-step research process was implemented. Briefly, these four steps are --

1. the identification of new and changing occupations;

2. the collection of information on the identified occupations;

3 the location of curricula and program offerings that prepare individuals for the identified occupations; and

4. the assessment of need for the development of curriculum for the identified occupations. (Orth and Russell 1980)

The methodology will be more completely described in the next chapter of the report. The results of the research and a description of those occupations explored in depth are presented in chapter 3. The final chapter is a summary of the results.

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Forgione, Pascal D. Jr., and Kopp, A. Lee. Curriculum Development Needs for Vocational Education: New and Changing Occupational Areas. Columbus, OH: The National Center for Research in Vocational Education, 1979.

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CHAPTER 2

METHODOLOGY

As outlined in the Introduction, the process for determining curriculum development need for new and changing occupations involves-

1. identifying new and changing occupations through data analysis, the monitoring of legislative, economic, technological and social trends, and communication with professional associations, special interest groups and knowledgeable individuals;

2. collecting occupational information for designated career fields (job descriptions, skills and aptitude requirements, preferred training levels, employer information, and career opportunities);

3. locating curricula, civilian and military, currently available for training people in the new and changing occupations; and

4. assessing the gaps between training needed for new and changing occupations and the available curricula. (Orth and Russell 1980)

A flow chart of the methodological process is provided in figure 2.1, "Methodology for Identifying New and Changing Occupations with a Curriculum Development Need."

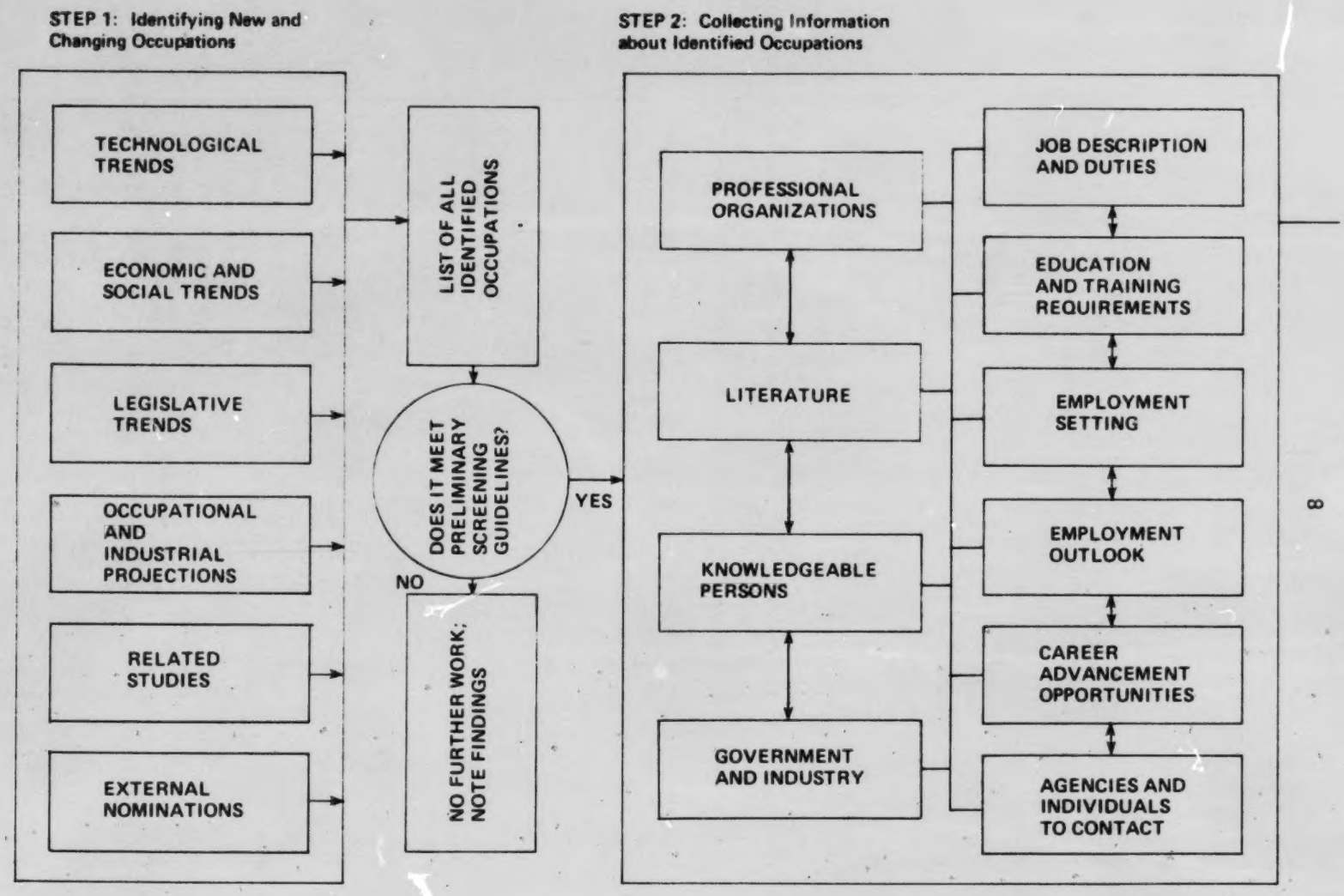
The contract through which this study was funded specified that no new data was to be generated (for example, survey research was not permitted). Therefore, the methodology relies upon the collection and use of existing information. This policy reflects the concern for avoiding a duplication of effort and for making use of already available data.

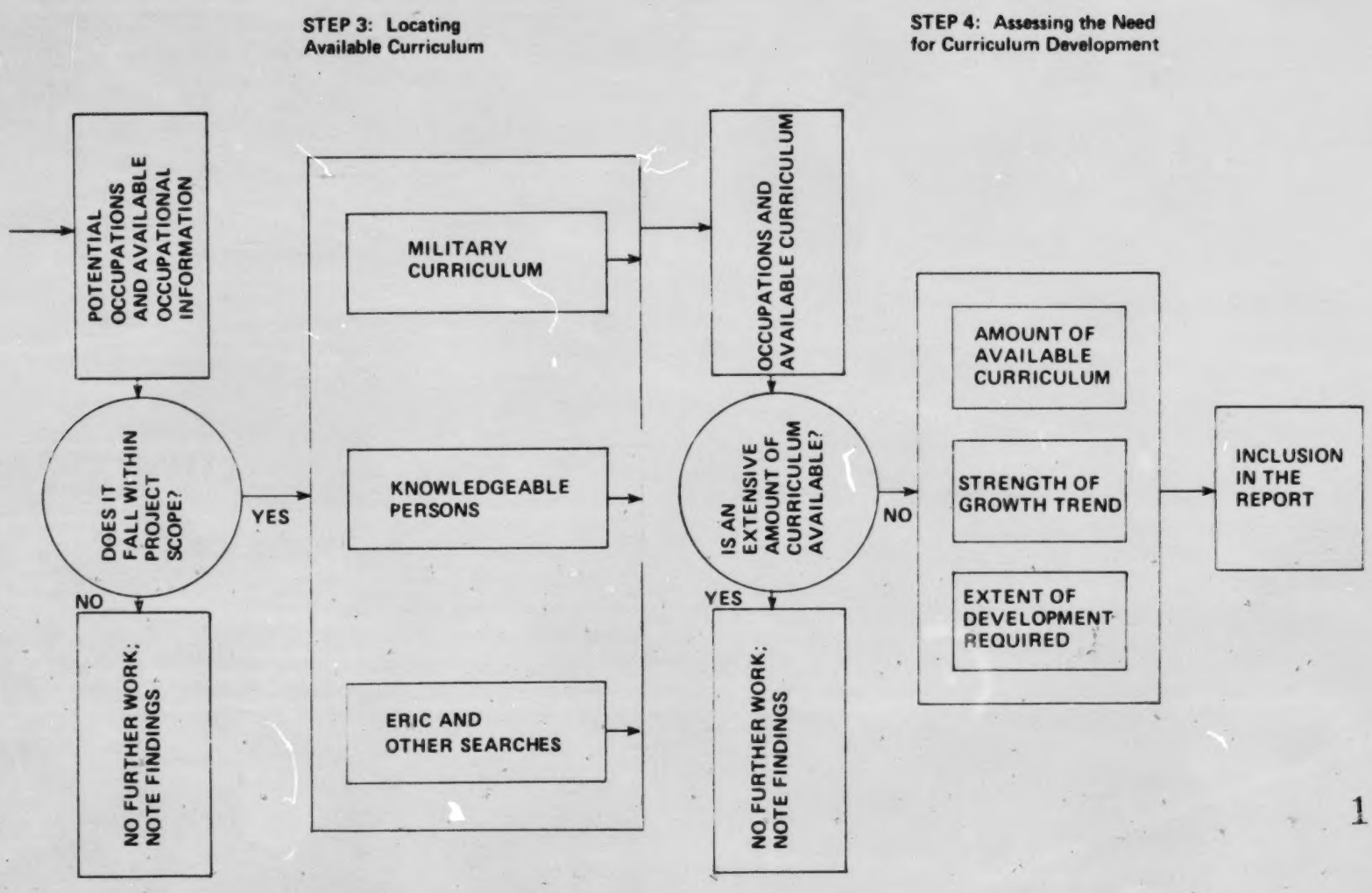
A brief description of each of the four steps follows. For more complete elaboration on the details the reader may refer to Curriculum Development Needs for Vocational Education: New and Changing Occupations (Orth and Russell 1980). The methodology changed very little from year to year.

Identifying New and Changing Occupations

Initial identification or location of new and changing occupations can be accomplished in a variety of ways. In fact, it is imperative that more than one means be used, or the likelihood of "missing" or not hearing about an

FIGURE 2.1 METHODOLOGY FOR IDENTIFYING NEW AND CHANGING OCCUPATIONS WITH A CURRICULUM DEVELOPMENT NEED




STEP 3: Locating Available Curriculum
STEP 4: Assessing the Need for Curriculum Development
POTENTIAL OCCUPATIONS AND AVAILABLE OCCUPATIONAL INFORMATION
DOES IT FALL WITHIN PROJECT SCOPE?
YES
NO
NO FURTHER WORK; NOTE FINDINGS
MILITARY CURRICULUM
KNOWLEDGEABLE PERSONS
ERIC AND OTHER SEARCHES
OCCUPATIONS AND AVAILABLE CURRICULUM
IS AN EXTENSIVE AMOUNT OF CURRICULUM AVAILABLE?
YES
NO
NO FURTHER WORK; NOTE FINDINGS
AMOUNT OF AVAILABLE CURRICULUM
STRENGTH OF GROWTH TREND
EXTENT OF DEVELOPMENT REQUIRED
INCLUSION IN THE REPORT

appropriate occupation is too great. Several general sources of information were used in this study to identify new and changing occupations.

Technological, Legislative, Social, and Economic Trends

Monitoring trends in a range of areas can provide important signals about emerging or changing occupations. Technological developments can create or alter jobs because new equipment or new uses may require new skills for operation or implementation. Legislation can create an instant demand for specifically skilled labor. For example, environmental protection legislation caused a need for environmental specialists who could monitor the impact of the newly created regulations.

Social and economic trends also affect the supply and demand for particular types of expertise. If people in a given society come to value a specific service more and more (such as child care, because more women are working), then the need for persons prepared to offer that service rises.

Occupational and Industrial Projections

Projections of employment and of industry growth, which may impact on employment, are often developed by professional organizations, advocacy groups, local agencies, and of course by state and federal agencies. The Department of Labor publishes projections that are very useful. For example, the Bureau of Labor Statistics has estimated the employment and growth for 377 occupations through 1985. Although most very new occupations are not included in this type of projection, changing occupations are often represented (U.S. Department of Labor n.d.).

Related Literature

The need for information about new and changing occupations has caused a number of studies to be undertaken by various organizations seeking to collect or generate facts. Local community and technical colleges have surveyed employers, state departments of education have commissioned analyses, and professional organizations have conducted research on new occupations within their profession. The findings from these types of studies have served as input into this process of identifying new and changing occupations that may have need of curriculum development.

Futurist literature was examined also. In several cases it was helpful in pointing out areas of technological development that might result in new occupations. Usually, however, the futurist literature is more general than

specific. The degree of speculation involved often precludes any immediate conclusions about the need for curriculum development.

External Nominations

During the second year of this project (1979-80), informal requests for nomination of new and changing occupations were solicited from over 500 organizations (professional associations, advocacy and interest groups, and vocational education organizations). Some of the responses were received too late to be considered during the second year of study and were followed up more closely in this, the third year.

An external nomination process, a review of related literature; the monitoring of social, economic, technological and legislative trends; and an analysis of available occupational projections all went into the preliminary identification of new and changing occupations.

Collecting Occupational Information

The next methodological step involved collecting occupational information about those occupations identified for further study. This was to insure that the occupations fell within the scope of the study and were (1) actually new or changing, (2) national in representation, and (3) within the realm of vocational and technical education. Information was collected also so that the reader would be able to make more informed decisions in considering curriculum development efforts or new program initiatives.

The process used for gathering information about the new and changing occupations involved tapping many resources and asking a variety of questions. The information needs, or aspects about the occupation, which were considered important for inclusion in the study were the following:

A. Job description and duties

1. Alternative job titles
2. Job description
3. Job duties
4 Wages and hours
5. Barriers and constraints

B. Education and training requirments

1. Degree or certificate program
2. Apprenticeship program
3. On-the-job training
4. Professional standards

C. Employment outlook

1. Expansion
2. Replacement
3. Future projections
4. Geographic factors

D. Employment settings

1. Industry
2. Product or service
3. Size of typical employer
4. Usual recruitment and hiring practice

E. Career opportunities

1. Present source of workers
2. Career ladder possibilities
3. Transferable skill areas

F. Agencies and individuals knowledgeable about the occupation

1. Professional associations
2. Renowned experts
3. Government agencies
4. Colleges and universities
5. Employers (Orth and Russell 1980)

The information was gathered by contacting (often by telephone) employers, government regulatory agencies, instructors or educational administrators, technical experts, professional association staff, and manufacturers. Specialized literature was also reviewed. This information collection process at times merged with Step One, the identifying of new and changing occupations.

Locating Curricula

The U. S. Office of Adult and Vocational Education, which directed the National Center to conduct this study of new and changing occupations, also wanted to know if a curriculum need existed for these occupations. The availability or lack of curricula, both civilian and military, was to be considered. If military curricula were available they could be reviewed for adaptability to the civilian sector, if appropriate. The scope of the project did not allow for evaluation of civilian curricula, however.

To locate curricula for new and changing occupations involves talking with experts about training programs and materials with which they are familiar, and searching the

literature in several critical data bases. The armed services training catalogues are also reviewed (Department of the Navy, Education and Training Command 1980) (Department of Navy, U.S. Marine Corps 1980) (Department of the Army 1980) (U.S. Air Force 1975).

The general data bases searched in this project are the following:

1. ERIC (Education Resources Information Center)

2. AIM/ARM (Center for Vocational Education)

3. NICEM (National Information Center for Educational Media)

In addition, very specific data bases were reviewed for curricula applying to one occupation. For example, in looking for curricula concerning new technology in welding, the WELDASEARCH data base was examined.

The computerized literature searches and discussions with experts can provide a reference to curricula and perhaps a brief description. However, the quality or comprehensiveness of the curricula could in no way be addressed through this project (except in the case of military curricula, if attainable).

Assessing the Need for Curriculum Development

Since curriculum can be and often is developed by many parties at different levels of the education delivery system, there is no assurance that all available curricula have been located. However, after identifying a new or changing occupation, collecting information about it, and locating curricula, one must attempt to assess the need for curriculum development. This assessment can be somewhat subjective, in that the quality of what is available is unknown.

Factors which need to be considered include:

1. the amount (or numbers) of available curricula,

2. the strength of the growth or change trend of the occupation, and

3. the extent of development which seems necessary. (Orth and Russell 1980)

Usually, some curriculum exists somewhere for the preparation of people for an occupation, even new occupations. The case that no curriculum at all exists is very rare. How many curricula are enough to insure that if a school or

college wanted to establish a new program, there would be adequate models for review and adaptation available? The arbitrarily determined number of twenty was chosen as a criteria to judge the adequacy of the quantity of available curricula.

The strength of the growth patterns for a new occupation can affect the need for curriculum development. If it is clear that expansion will take place, the need for curriculum is greater, since more schools and colleges would be establishing programs. Similarly, the strength of the change affecting a changing occupation should be considered when determining the need for curriculum development or modification.

Determining the extent of development needed to assure a comprehensive curriculum is another part of assessing the need for curriculum development. That is, is combining two existing curricula what is needed, or is one course needed, or is an entire two-year program curriculum needed?

The process of assessing the need for curriculum development involves an awareness of the extent of curriculum development needed, the amount of curricula available, and the strength of occupational growth trends.

Conclusions About the Methodology

The methodology for identifying and analyzing curriculum development need for new and changing occupations is not a simplistic process. Asking a variety of questions of many people and searching through many source documents is required.

Because of the wide range of input utilized, a certain amount of bias is also introduced. People who have a stake in the growth of an occupation are often the ones with the greatest amount of information. An employer or manufacturer may have excellent statistics regarding an occupation, but may not wish to reveal "trade secrets."

Also, the nature of the occupations being studied, new and changing ones, affects the reliability of the data. What may be a correct conclusion at a given point in time may be incorrect a year later.

Access to curriculum can be a problem. An excellent course outline and materials may exist somewhere. However, if it is not entered into a data base, or is not known to the people with whom project staff confers, or is not captured in a published document, the utility value decreases significantly.

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CHAPTER 3

RESULTS

A description will be provided within this chapter of the fifteen occupations studied that have some degree of curriculum development need. The descriptions for the first seven of the occupations are more complete, in that information was collected and is provided about the following topics:

- o Job functions, duties and specifications
- o Education and training requirements
- o Employment outlook
- o Employment setting
- o Career advancement opportunities
- o Available curricula and programs
- o Implications for curriculum development

Even within these seven occupational descriptions, there is a difference in detail levels. If a curriculum outline or list of schools was readily available, it was included within the description. For some of the occupations, no such information has been published. When such information has been provided it is not be be considered as an official endorsement by the National Center.

The seven occupations are as follows:

<u>New</u>

- o computer drafting and/or graphics technician
- o neureometrics technician

<u>Changing and or experiencing new growth</u>

- o cable television technician
- o catfish farm manager
- o locksmith
- o speech-language hearing assistant specialist
- o word processing specialist

A modified occupational description will be provided for eight occupations. The modified format is being used for these occupations for a variety of reasons. In one case, the need for curriculum development exists for a changing occupation, but the price of the necessary equipment to teach

the new skills would be prohibitive to in-school programs. In another case, the technology is new and vocational educators need to be aware of its presence, but at the current time there appear to be few occupational implications of the new technology. Regardless, the author felt the reader needed to be informed about these occupations, but that a full scale description was either impossible or not necessary. The eight occupations for which a modified description is provided are as follows:

New

- o fiber optics technician
- o perfusionist

Changing and/or experiencing new growth

- o aviation maintenance technician
- o electromyography technician
- o hydroponic agriculture specialist
- o instrumentation technician
- o personnel and labor relations specialist
- o welder

Both the complete and modified occupational descriptions follow. As mentioned earlier, other new and changing occupations with a need for curriculum development are discussed in two documents published previously by the National Center (Forgione and Kopp 1979) (Orth and Russell 1980). All of the occupations to be presented herein are national in scope and fall within the realm of vocational education.

REFERENCES

Forgione, Pascal D. Jr. and Kopp, A. Lee. Curriculum Development Needs for Vocational Education: New And Changing Occupational Areas. Columbus, OH: The National Center for Research in Vocational Education, 1979.

Orth, Mollie N., and Russell, Jill Frymier. Curriculum Development Needs for Vocational Education: New and Changing Occupations. Columbus, OH: The National Center for Research in Vocational Education, 1980.

Full Descriptions of New Occupations and Their Curriculum Development Needs

Computer Drafting and/or Graphics Technician

Neurometrics Technician

Computer Drafting and/or Graphics Technician

> Computer-oriented interactive graphics represents the combination of a computer and a graphics output (and input) device as a medium by which a user manipulates visual information. The end result may be the design of an automobile, the teaching of a lesson in electromagnetic field theory, the training of an airplane pilot, entertainment such as animated cartoons, or the manipulation of colors, masses, and forms to produce purely artistic designs. (Burchi 1980)

Computer drafting and computer graphics are being used more and more in all types of industry to accomplish numerous objectives. In general, the applications of computer graphics fall into one of the following six areas:

1. Management information
2. Scientific graphics
3. Command and control
4. Image processing
5. Real-time image generation
6. Electrical and mechanical design (Machover 1977)

Personnel capable of working at various levels of computer graphics technology are coming into demand as the uses are expanded and productivity benefits realized.

Functions, Duties, and Specifications

Computer graphics involves the use of an automatic drafting machine which is controlled by the computer graphics system. The automatic drafting machine produces inked drawings at a nearby drawing table (or a remote location via telephone-like communications) at the command of the computer graphics technician (Faulkner 1980).

> Computers now draw line sketches, diagrams and charts for engineering, architectural and space projects. This use of computers for illustration of technical data is called computer graphics. By bringing together the research of several electronics engineers, Dr. Ivan E. Sutherland of the Evans and Sutherland Computer Corporation of Utah has programmed computers to draw three dimensional

color on black-and-white solid pictures on the face of a two dimensional television screen. The flat images of solid objects move to show their hidden surfaces in accordance with programmed instructions; they are also enhanced by realistic light and dark tones, like movie or television pictures. (Rosen 1976)

Functions or services provided by computer graphics devices are as follows:

1. Graphics display of computation results as they occur
2. Replacement of paper as a drafting medium
3. Rapid presentation of large quantities of information
4. Observing and influencing change
5. Visualization of nonexistent or rebuilt objects for rapid study of design options
6. Enhancement of interpretation or impact of data
7. Visual communication to replace alphanumeric man-machine communication
8. Process simulation and verification before committing real resources
9. Simulation of real-world scenes
10. Graphics representation and observation of simulated theoretical models
11. Creation of artistic designs
12. Entertainment (Burchi 1980)

According to Carl Mackover of Mackover Associates, the percent of penetration in terms of computer drafting is small now but will increase over the next ten years. By then, ten to twenty percent of drafters will be using computers in drafting.

"The type of drawing a drafter prepares depends upon the discipline of engineering or science for which he is making the drawing and how the drawing is to be used" (American Institute for Design and Drafting 1980 n.d.). Drawings may be classified into several types. The following are the more common:

1. Design or construction drawing-- These are used to instruct on how to fabricate, build or erect a plant, building or product in such fields as aeronautics, architecture, machine design, mechanical engineering, electrical engineering, and electronics. These drawings are usually drawn to scale, giving complete information as to the material and dimensions.

2. Technical illustration-- These are generally used to convey information as to the shape, size, location and function of an item. Examples would include patent drawings, illustrations for parts catalogues, assemblies, and dimensions, and are generally artistic.

3. Maps, geological sections and highway plats-- These are used for locating property lines, physical features, strata, right-of-way, building sites, bridges, dams, mines, utility lines, etc. These types of drawings are usually prepared in ink on film because they are more permanent than other types of drawings and used more often as reference. (American Institute for Design Drafting 1980)

Job duties and responsibilities for a designer or a design drafter, as outlined by the American Institute for Design and Drafting, are as follows:

Designer:

1. Handles complex or multiple design assignments.

2. Is creative with design capabilities.

3. Has good understanding of engineering and design principles related to a specific area of work.

4. Receives assignments directly from persons requesting work.

5. Checks and/or approves all work on projects delegated to him.

6. Prepares studies and reports for estimates, progress, evaluations.

7. Substitutes for supervisor during his absence.

8. Has wide latitude for the exercise of inventiveness and independent judgement.

Design Drafter:

1. Handles design-drafting assignments.

2. Exercises considerable judgement in design and layout.

3. Schedules work on projects and reports on progress (American Institute for Design and Drafting n.d.).

"Drafters usually work in well-lighted and well-ventilated rooms, however they must sit for long periods of time during very detailed work" (U.S. Department of Labor 1978, p. 385-6). "In private industry, tracers averaged about $8,490 a year in 1976, while more experienced drafters averaged between $9,800 and $12,000 a year. Senior drafters averaged about $15,300 a year in 1976. On the average, experienced drafters earn about one and one-half times as much as the average earnings of nonsupervisory workers in private industry, except farming. The federal government paid drafters having an associate degree starting salaries of $8,316 a year in 1977. Those with less education or experience, $7,408. The average federal government salary for all drafters was about $11,000 a year" (U.S. Department of Labor 1978, p. 385-6).

Karl Seaman of Utah Technical College states that "most companies have computer graphics separated from the regular drafting section. Many times employees switch back and forth. There is a need for the 'know-how' of old drafters and new computer people. There is also much time spent in typing instead of pencil in hand" (Seaman 1980).

Education and Training

Computer qraphics systems do not eliminate or reduce the drafting expertise needed by the individual. The fundamental skills of graphics and engineering drawing are needed prior to training in computer drafting techniques. Computerized systems expedite the mechanics of producing visual representations of objects or systems, they do not replace the necessary individual skills. Therefore, the early training of an individual for computerized graphics is unchanged from past requirements and must include the following:

- Multiview drawing
- Orthographic projection
- Oblique projections
- Perspective projection

- Sections and convention
- Pictorial drawing
- Dimensional convention
- Special field procedure for architecture, engineering, charting, and mapping

Computer drafting systems are not a substitute for these skills; therefore, computer drafting and graphics training must occur after an individual has had training in the fundamentals of the profession. Computer graphics training could include a course in basic computer programming and a course in computer graphics after one or more traditional courses in drafting or engineering graphics is completed (Faulkner 1980).

The standard schooling for an individual who will develop computer software for drafting programs is four years. Dr. Anthony Lucido of INTERCOMP, a company in Houston, Texas, feels that the person who does the programming for computer graphics requires even more education and skill than a regular computer programmer. On the other hand, training a drafter to use computer equipment can be accomplished in a week to a month of on-the-job training. Or, drafting programs in schools can offer a specialized course in the use of the computer (Lucido 1980). Companies may be required to share in the training of computer graphics skills by the use of company taught courses or by sending personnel to specialized short courses (Faulkner 1980).

At Utah Technical College, where a computer graphics system has recently been purchased, two-year graduates are the ones who use the system after the computer software has been developed. These two-year graduates of drafting programs usually take a one-quarter course in computer graphics (Seaman 1980).

All information to this point leads to the conclusion that computer drafting or graphics technicians must be skilled first as a drafter, or graphics specialist by acquiring the necessary training in a technical institution, junior or community college, continuing education at a college or university, vocational-technical secondary institution or trade school. "Some persons receive training and experience in the armed forces. Others qualify through on-the-job training programs combined with part-time schooling or three to four year apprenticeship programs" (U.S. Department of Labor 1978, p. 385-6). In conjunction with the above types of training, the technicians learn the computer-related skills.

From high school, "graduates of drafting usually start out as tracers and those having post high school training may begin as junior drafters. After gaining experience, they may advance to checkers, detailers, senior drafters, or supervisors and some may become independent designers. Courses in engineering and mathematics sometimes enable drafters to transfer to engineering positions" (U.S. Department of Labor 1978, p. 385-6).

Employment Outlook

Employment of drafters is expected to increase faster than the average for all occupations. This growth, along with the need to replace those who retire, die, or move into other fields of work, should provide favorable job opportunities through the mid-1980s. Holders of an associate (two-year) degree in drafting will have best prospects. Many large employers already require postsecondary technical education, though well-qualified high school graduates who have studied drafting may find opportunities in some types of jobs (U.S. Department of Labor 1978). Employment of drafters is expected to rise rapidly as a result of the increasingly complex design problems of modern products and processes. In addition, more support personnel will be needed as the employment of engineers and scientists grows. Photo-reproduction of drawings and expanding use of electronic drafting equipment and computers, however, will reduce the need for less-skilled drafters (U.S. Department of Labor 1978).

At present, the job market for technically trained individuals in engineering and technology is rapidly increasing. As the need for technically trained employees increase and four-year engineering graduates do not meet the emoloyment demand, the need for computer graphics technicians will increase. Computer graphics technicians will be expected to relieve the work load of engineers to a greater extent with the latest time-saving systems and techniques (Faulkner 1980).

Employment Setting

"Usually supporters of large drafting rooms, such as utility companies tend to hire drafters" (Ryan 1980). However, practically every type of industry in America, including the government, employs drafters. According to the U.S. Department of Labor, about ninety percent are employed in manufacturing companies, architectural and consulting firms, and construction and mapping companies" (American Institute for Design and Drafting n.d.).

Career Advancement Opportunities

The biggest advancement opportunities in the field of drafting, are for the two-year technical graduates (Ryan 1980). With formal education, a draftsperson could advance to being an engineering designer or software developer for computer drafting.

Available Curriculum and Programs

Listing 3.1 indicates the two-year postsecondary schools offering design-drafting programs that are certified by the American Institute for Design and Drafting. Most drafting programs do not currently include computer drafting curricula. Only a few text books have been developed to introduce the subjects of computer graphics and drafting (Ryan 1979).

Implications for Curriculum Development

There are very few curricula and only a few programs available to train draftspersons in the use of computer drafting. The trend toward using this medium will in all likelihood continue and grow. Additional materials are needed, as is program implementation.

Additional curricula are needed to meet the projected demand for computer graphics/drafting trained individuals. Such curricula could be instituted in the following institutions: two-year technical schools, four-year technical schools, private technical institutes, private company training programs, community colleges, or adult education institutions. It does not appear that such training is viable in high schools.

Three major requirements will limit the training of individuals in this profession:

1. Availability of qualified teachers
2. The purchase cost of such systems for educational institutions
3. Dissemination of career opportunity information to potential students (Faulkner 1980)

LISTING 3.1

TWO YEAR POSTSECONDARY DESIGN-DRAFTING PROGRAMS
CERTIFIED BY THE
AMERICAN INSTITUTE FOR DESIGN AND DRAFTING

DESIGN DRAFTER

Technical College or Institute

916 Area Vo-tech Institute
White Bear Lake, Minnesota 55110

Cameron University
Lawton, Oklahoma 73505

Center for Degree Studies
Scranton, Pennsylvania 18515

Clinton Community College
Clinton, Iowa 52732

Craven Community College
New Bern, North Carolina 28560

Detroit Engineering Institute
Detroit, Michigan 48226

Eastfield College
Mesquite, Texas 75150

Faribault Area Vo-tech Institute
Faribault, Minnesota 55021

Hutchinson Area Vo-tech Institute
Hutchinson, Minnesota 55350

Jefferson College
Hillsboro, Missouri 63050

Kirtland Community College
Roscommon, Michigan 48653

Madison Area Technical College
Madison, Wisconsin 53703

New England Institute of Technology
Providence, Rhode Island 02905

New Hampshire Vo-tech College
Berlin, New Hampshire 03570
Claremont, NH 03743
Portsmouth, NH 03801

Northwest Iowa Tech College
Sheldon, Iowa 51201

Oklahoma State Tech
Okmulgee, Oklahoma 74447

Parkersburg Community College
Parkersburg, West Virginia
26101

Porter and Chester Institute
Enfield, Connecticut 06082
Rocky Hill, Conn 06067
Stratford, Conn 06497
Waterbury, Conn 06721

Southeast Community College
Milford, Nebraska 68405

Stark Technical College
Canton, Ohio 44720

Texas State Technical Institute
Waco, Texas 76705

Thomas Area Technical School
Thomasville, Georgia 31792

Utah Technical College at
Salt Lake
Salt Lake City, Utah 84107

DRAFTER

Community College or Vo-Tech

Brunswick Junior College
Brunswick, Georgia 31520

Clackamas Community College
Oregon City, Oregon 97045

Cochise College
Douglas, Arizona 85607

Delta College
University Center, Michigan 48710

Hall Institute
Pawtucket, Rhode Island 02860

Hutchinson Community Jr. College
Hutchinson, Kansas 67501

Kalamazoo Valley Community College
Kalamazoo, Michigan 49009

Manhattan Area Vo-Tech College
Manhattan, Kansas 66502

Northwest Iowa Tech College
Sheldon, Iowa 51201

Oklahoma State Tech
Okmulgee, Oklahoma 74447

Pinellas Vo-Tech Institute
Clearwater, Florida 33520

Southeast Community College
Lincoln, Nebraska 68520

Vincennes University
Vincennes, Indiana 47591

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Neurometrics Technician

Neurometrics is a very new biomedical technology which provides "quantitative information about brain activity related to anatomical integrity, developmental maturation, and mediation of sensory, perceptual and cognitive process" (John 1977). That is, neurometrics, through the use of a computer, expands information normally collected through electroencephalographic (EEG) techniques. The information usually provided by an EEG is in a numerical form, plus additional data is collected in regard to the "brain functions concerned with reception, encoding, processing, and evaluation of information." (John et al. 1977) For example, neurometrics can be used with children to measure the maturity of the brain, or can be used with ill or older people to measure brain dysfunction.

A neurometrics technician will have similar functions as a electroencephalographic technician, only will be using somewhat different equipment.

Functions, Duties, and Specifications

The duties of the neurometrics technician will include:

1. taking a simplified medical history of patient,
2. helping the patient relax for the test;
3. applying electrodes to the designated spots on the patient's head and measuring impedance,
4. choosing the most appropriate combination of instrument controls and electrodes to achieve desired type of data,
5. operating the neurometric equipment and computer input, and
6. recognizing and correcting artifacts that appear (electrical or mechanical events that come from somewhere other than the brain). (U.S. Department of Labor 1978)

Another individual, probably with a Master's or Ph.D. level degree in education, physiological or clinical psychology, will interpret the data produced for the requesting source. An M.D., a registered nutritionist, or a school psychologist, for example, will have originally requested that a neurometric analysis be completed.

Persons planning to become neurometrics technicians "should have manual dexterity, good vision, an aptitude for

working with electronic equipment, and the ability to work with patients as well as other members of the hospital team" (U S. Department of Labor 1978, p. 472-3).

Education and Training

The field of neurometrics has not yet become standardized enough to specify the educational criteria necessary to become a neurometrics technician. An individual who is already an EEG technician would need only an additional course and possibly an internship to qualify as a neurometrics technician (Thatcher 1980).

An individual without previous preparation would need a more comprehensive curriculum, including study in neurometrics, computers, "neurology, anatomy, neuroanatomy, physiology, neurophysiology, clinical and internal medicine, psychiatry, electronics, and instrumentation" (U.S. Department of Labor 1978, p. 472-3).

The EEG field does have a registration process involving written and oral exams at the technologist (rather than technician) level. This process could evolve also in neurometrics, as usage becomes more widespread.

Employment Outlook

The employment of EEG technicians is projected to grow more quickly than most occpations. There were approximately 4,300 persons involved in EEG work at the technologist and technician level in 1976. EEG's are being used increasingly "in surgery and in diagnosing and monitoring patients with brain disease" (U.S. Department of Labor 1978, p. 472-3). As neurometrics expands even more, both the potential uses of data regarding brain wave frequency and the need for persons qualified at the technician level will increase. Of course, at first an EEG technician will just need to obtain the additional training on neurometrics. Later, in all likelihood, people will have the neurometrics and EEG training together. Therefore, the demand for neurometrics technicians will be met primarily at first by EEG technicians with extra training.

The neurometrics movement, at present, is quite small. The first article on the subject was published approximately five years ago. One company presently exists to market neurometrics equipment (Grupsmith 1980). About five sites presently use the equipment on a research and development basis (including the Menninger Foundation in Topeka, Kansas) and about twenty-six universities nationwide are interested in neurometrics research. Spokesmen for the National Institute of Health have stressed the need for standardization of

research concerning EEG and evoked potentials. The standardized formats and reporting within neurometrics have been selected as the standard for the twenty-six universities currently forming the consortium of universities interested in neurometrics research (Thatcher 1980).

Employment Settings

Most EEG technicians have traditionally worked in either hospitals, or private offices of neurologists and neurosurgeons. However, neurometrics equipment will probably be located in more sites (rehabilitation centers, centralized school system offices, and so forth) because of the more diversified uses. Therefore, neurometrics technicians will be working in a variety of places.

Career Advancement Opportunities

Due to the newness of this field the career advancement potential is not yet clear. It is possible that with further training a neurometrics technician could advance to the technologist level (if such a position existed) or on to the interpretation level, if advanced, graduate degrees were attained.

Available Curriculum and Programs

Nine EEG training programs which had obtained American Medicare Association approval existed in 1976.

No formal training is currently available for neurometrics technicians, although the manufacturer of the equipment trains persons in its usage when equipment is purchased. In addition, Robert Thatcher, the Director of the Applied Neuroscience Institute of the University of Maryland Eastern Shore, offers an introductory level workshop on neurometrics on a yearly basis. It is not, however, specifically designed to train technicians (though "hands on" time is provided within the workshop).

If, and when, an American Neurometrics Society is formed, the organization might be in a position to offer upgrading or other training (Thatcher 1980).

Implications for Curriculum Development

The advancing use of neurometrics should be observed carefully by vocational education planners. If adoption of this new technology takes place as expected, new people will need comprehensive training to be neutrometrics technicians, and existing EEG technicians will need additional training. The curriculum for the neurometric aspects (as separated from the existing EEG curriculum) will need to be developed.

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Full Descriptions of Changing and/or Growing Occupations and Their Curriculum Development Needs

Cable Television Technician

Catfish Farm Manager

Locksmith

Speech-Hearing Language Assistant

Word Processing Specialist

Cable Television Technician

The cable television industry began about thirty years ago for the purpose of bringing television service to remote parts of the country (urban areas were already being served by the affiliates of the three national networks). More recently cable television (TV) has expanded into the cities and is providing greater options in television viewing and improved reception for its new customers. This urban market has grown rapidly, and with that growth the need for technicians who install and service cable TV equipment has also increased (Satin 1980) (Lloyd 1979).

Functions, Duties, and Specifications

Cable TV technicians are needed at several levels of installation and service. Installer's principal duties include:

1. connecting and disconnecting cable service,
2. checking locations for serviceability,
3. completing required paperwork, and
4. assuring vehicle maintenance. (Taylor 1980)

The installation activity involves driving to the new customer's home, determining the best place to locate the entrance of the cable into the home, actually connecting the equipment to the television, and recording that the specific address is now receiving cable service. Installers must also communicate with the customer and be able to respond to questions.

Service technicians' duties may vary according to whether they work with production aspects, troubleshooting at the customer's end, or preventive maintenance regarding electronics between the studio and the individual recipients. Accordingly, the job titles often vary also. In general, service technicians must:

1. locate and repair defective parts, equipment or conditions,
2. use various test equipment,
3. document conditions and corrective measures, and
4. complete on-going maintenance tasks. (Taylor 1980)

There is a variety of types of installations (multi-tier systems, two-way systems, and systems offering other services--such as security alarms and smoke detectors). Installers and technicians need to be able to work with whatever types of systems their employing firm uses. If additional services are added, the technicians need additional training.

Salaries vary dependent upon geography of the country, local labor supply and level of responsibility. Installers usually receive lower wages than service technicians.

Education and Training

Although very few two-year technical programs exist for training cable TV technicians, the need for persons trained in these types of programs is great ("Staffing Your Facility - A Symposium" 1979) (Manning 1980). Technicians need a basic electronics background and a curriculum emphasizing such areas as service techniques, technician safety, various circuits, splicing, equipment, cable TV problems, trunk and distribution operations, and interference. There is a "need to update and continuously revise television and related media courses in colleges and other educational institutions" (Danna 1980).

Employment Outlook

Cable television as an industry has been projected by the U.S. Department of Commerce to grow from 15.2 million subscribers in 1979 to 20 million in 1983 ("Cable Growth Projected" 1979). Not included within this projection is the September 1980 ruling of the Federal Communication Commission permitting "a new television broadcast service with low-power "mini" stations that could originate an unlimited amount of programming" ("FCC Gives OK" 1980). This authorization means that many small communities will be able to have television for the first time. Cable systems will be allowed to own these stations, but the major networks will not be so permitted.

The fact that cable companies must compete with other firms to attain urban franchises means that being able to offer multiple services is an advantage. Therefore, the necessity to engage technical personnel who can operate the various services is evident to the cable companies (Manning 1980).

In addition, "new and changing uses for video are always emerging, especially in the areas of business, industrial and general institutional applications" (Danna 1980). Therefore, even while there is currently "a radical shortage of qualified technical people" (Lloyd 1979), additional growth of the industry is expected.

Employment Settings

Cable television stations are located throughout the country in both rural and urban settings. Some large cable companies have production capabilities and connections with other cable firms which permit, in essence, national

broadcasting. Other cable firms simply pass on the traditional network programming to remote areas.

Because it is so difficult to locate trained technicians in some cases the cable station --

1. hires people in at the entry level installation position,

2. provides on-the-job training, and as the personnel gain experience,

3. promotes them to higher technical levels.

Recruitment and hiring are accomplished through national trade journal advertising, newspaper advertising, school placement efforts, and employment agencies, as well as the more common means (such as word of mouth).

Career Advancement Opportunities

As indicated earlier, some technicians begin cable work at very entry level positions and advance as they are able. The usual requirement for the entry level installation position is a high school degree and a driver's license. The increasingly technical positions require associate degrees and/or equivalent experience and expertise. Technicians can advance to the position of chief technician or supervisor of technicians for their station or cable company.

There is much lateral movement within the cable industry. Technicians are often sent from city to city for installation or must move to achieve upward mobility (Manning 1980) (Pettiross 1980).

Transferable skills of cable television technicians would include their electronics background and their television and audiovisual experience. These technicians could, therefore, move into other electronically oriented occupations or into other phases of television production and broadcasting. If their preparation includes an introduction to business concepts, movement into management is facilitated.

Available Curriculum and Programs

A great many broadcasting schools, electronics programs, and engineering curricula currently exist. All of these are relevant to cable TV technician training. However, according to James Lloyd, the president of a national recruiting firm for the audiovideo industry, "There are a few two-year maintenance programs around, and we are placing these

students as fast as they can graduate" (Lloyd 1979). Some cable companies are establishing their own formalized training programs ("Warner Amex Institutes Job Training Program in Cincinnati" 1980).

Middlesex Community College in Connecticut offers a unique two-year cable degree which prepares people for almost all jobs within the cable TV industry. The program coordinator developed her own curriculum with the help of cable operators. For many subjects, field trips and guest lecturers serve as the primary source of information since texts and printed materials are unavailable (Pettiross 1980).

The Electronic Industries Association has developed a series of textbooks related to television servicing. These materials are available through national commercial publishers. The Association also sponsors summer seminars for teachers who expect to be offering courses on television service (Koscheila 1980). This organization, whose membership is composed of all the major electronic equipment mamufacturers, is available to assist technical schools and community colleges which are interested in developing programs ("Staffing Your Facility--A Symposium" 1979).

Implications for Curriculum Development

Portions of the curriculum needed to prepare cable television technicians are in existence (for example, basic electronics and television servicing). This is because a great number of broadcasting and communications programs are offered throughout the country. Few two-year programs have been organized, however, which are specifically designed for cable television technicians. Both traditional electronics and broadcasting curricula could be expanded to successfully create cable TV technician programs. Or, new two-year curriculum can be devised, perhaps based on the few that are available.

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Catfish Farm Manager

In 1974, Walter Brooking advised technical educators to become more involved in preparing marine technicians and specialists (Brooking 1974). Catfish, salmon, prawn, clams, shrimp, trout, oysters, and lobster are being commercially grown and harvested in a variety of ways throughout the country. The technology is quite different according to the species. As technology and research improve the profitability of fish farming, the need for personnel trained in this specialized work will increase.

Of all the expanding types of fish and marine life production, catfish farming stands out in production and appears to be the most in need of personnel and curriculum development (Shell 1980) (Freeman 1980) ("Catfish -5.2.24" 1980). This description will focus, therefore, upon catfish farm managers, though the reader should be aware that the importance of many types of fish farming is growing.

Functions, Duties, and Specifications

Catfish farm managers have a similar job description as other agricultural managers, only they are working with livestock that is underwater. In general, the catfish farm manager oversees approximately 160 acres of pond, which is one commercial unit (Freeman 1980). The activities which are most important follow:

1. Stocking Ponds-- This involves insuring that the right numbers of fish at the right size and weight are stocked in the pond and that they have received treatments for parasites and disease.

2. Fish feeding-- This activity requires learning the correct quantities to feed the fish, feeding the fish at the correct times, keeping records of the feed inventory, and watching the responses of the feeding fish.

3. Parasite and disease control-- This involves checking periodically for diseases, and so forth, and knowing how to treat the given problems. Also, calculation of treatments to be added to the water is necessary.

4. Oxygen monitoring-- From April through September, the oxygen content of the water must be monitored. Familiarity with instrumentation is important for this duty.

5. Servicing equipment - Tractors and aerators and

other equipment must be maintained and simple repairs must be made on occassion.

6. Record keeping-- Stocking records, oxygen records, and maintenance records (to name a few) are necessary in fish farm management.

7. Purchasing and sales-- Dependent upon the farm and whether or not it produces its own fingerlings (baby fish stock), a farmer may have to arrange for purchasing of stock. Also dependent upon the sales arrangement (some farmers have agreements to supply one larger distributor), a farmer may need to be involved with postharvesting sales activities (Williamson 1980).

Catfish farm managers must often be "on call" twenty four hours a day, especially during the summer months when low oxygen levels may lead to mass mortality of stocked fish. They may also be required to live on-site and have to check on the water in the middle of the night and in the winter, for example. Physical requirements of the job are demanding and total committment is necessary.

Catfish farm managers usually receive a base salary, housing with utilities, and a commission. The commission is based upon a percentage of the harvest (Freeman 1980).

Education and Training

Although baccalaureate-trained persons are often hired as catfish farm managers, a four-year degree is not really necessary to accomplish the job. Two-year technical training, if designed to emphasize practical aspects of catfish farming, would be appropriate (Freeman 198[illegible]) (Williamson 1980).

However, very little two-year training is currently available for preparation of catfish farm managers (Shell 1980) (U.S. Department of Commerce n.d.).

Subjects of study particularly important to the preparation of catfish farm managers include the following:

1. Biology
2. Chemistry
3. Freshwater Ecology
4. Technical Mathematics
5. Hatchery Management

6. Aquacultural Production

7. Feeds and Feeding

8. Disease and Parasite Control

9. Instrumentation and Equipment

10. Harvesting, Processing and Marketing

11. Farm Management

Employment Outlook

Catfish farming has grown at substantial rates over the past ten years.

> In 1969, the National Marine Fisheries Service started collecting data on the processing of farm-raised catfish. In that year, five plants processed approximately 3.0 million pounds (live weight) into 1.7 million pounds of dressed fish. In the following three years, processing grew at a phenomenal rate, 39% to 49%. But, as the industry underwent its first adjustment period from 1973 to 1975, processing slumped to 7%, -16% and -5%, respectively. Then, the industry pulled itself together and processing increased 15% in 1976, 14% in 1977, 27% in 1978, and an estimated 28% in 1979. The total revenue received by catfish farmers from processing plants rose from 7.8 million dollars in 1975 to an estimated 25.1 million dollars in 1979. The value of the processed product in 1975 was 11.7 million dollars; the value in 1979 was an estimated 30 million dollars. ("Catfish-5.5.22" 1980)

Production is expected to double during the 1980s, according to International Resource Development, Inc. This projection is based upon the premise that successful marketing to fast-food and other restaurants will continue and expand ("Catfish-4.12.31" 1979). In addition, The National Agriculture Plan (a draft version dated May 1980) is recommending five million dollars be allocated for catfish farming over the next five years ("Catfish-5.7.26" 1980).

The aquaculture industry is perceived by much of the public to be "glamorous" (Chan 1968). Because of this widely held opinion, many persons seek education in oceanography and marine biology. Particularly at the graduate level, the supply of trained persons is adequate for the number of available jobs. Competition for the scientific and research-oriented (Jacques Cousteau type) positions is to be

expected (Rosenberry 1980). It is possible that some of this "glamour industry" image may be associated with catfish farming, although agriculture is not usually thought of as glamorous.

Utility companies are increasingly considering operating fish farms. This is because they have an abundant supply of warm water. The Public Service Electric and Gas Company in New Jersey has recently leased two hatcheries and may construct a full scale fish farm. The farm would raise trout in the winter, catfish in the summer, and employ close to 100 people (Day 1979).

To conclude, employment opportunities in catfish farming will grow because the business is growing. The world needs more food, and it is becoming more efficient to "grow" fish than to go out and "hunt" fish in their natural habitat (Freeman 1980) (Ross 1974).

Employment Setting

Currently there are approximately 5,000 catfish farmers, 300 of which have more than 250 acres of pond ("Catfish-5.10.30" 1980). Employment of farm managers (other than self-employment) is primarily among these 300 farms managers or any new farms which are large. Employment is to be found in thirteen states: southern states east of Texas to the Carolinas, and in areas of California, Arizona, and New Mexico, where access to free water is available (Freeman 1980).

Career Advancement Opportunities

Career advancement opportunities are not great in catfish farming. Any higher level position would be likely to require a graduate level degree, especially since there is a large supply of persons trained in marine sciences at the Master's and Ph.D. levels. While the opportunities for advancement are limited, there often are opportunities to increase the size of individual farms, for vertical integration of successful farms, and for farm ownership. All of these changes could result in increased responsibility and pay (Shell 1980).

Available Curriclum and Programs

There are very few, if any, curricula designed for the preparation of catfish farm managers. There are of course, segments or portions of curricula (biology, chemical analysis of water, and so forth) available which relate to catfish farming. However, no programs offered in schools for the specific purpose of preparing persons to be catfish farm

managers could be located. The National Oceanic and Atmospheric Administration of the U.S. Department of Commerce has completed an extensive survey of university curricula in marine science and related fields. For the academic years 1979-1981,
the survey lists twenty-four schools which offer degrees at less-than-the-baccalaureate level in marine science fields. None of these schools have a catfish farming program. Most are related to commercial fishing, marine boats and equipment, or oceanographic research and are found in coastal states. (U.S. Department of Commerce n.d.).

Implications for Curriculum Development

There is a need for curriculum development and program offerings in catfish farming. None appear to exist. Auburn University in Auburn, Alabama is considering the possibility of developing a two-year program. The Mississippi Delta Junior College (Moorehead, MS) and Hinds Junior College (Raymond, MS) have also indicated an interest in program development (Freeman 1980) (Shell 1980).

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Locksmith

Locksmithing is not a new occupation. Wooden locks have been found in the Egyptian pharoah's tombs and the first metal lock which could be mass produced was developed by Linus Yale in 1860 ("Locksmiths" 1980). Protection and security have been important issues to most people throughout time. No matter how poor individuals may be,they usually have something of value to protect. The increasing crime rate in the United States has caused people to become more conscious of securing their property and themselves. Locksmithing as an occupation is changing because of technological advances in electronic security systems. These advances not have only created more sophisticated security equipment, but have caused the need for technical experts where just a key-maker was sufficient in the past.

Functions, Duties, and Specifications

Traditional locksmithing tasks have included selling and installing locks, changing locks on doors and other items, repairing and rekeying all types of locks, helping people who were locked out of cars, duplicating keys, making new keys, and opening and servicing safes. Some of the newer tasks involve replacing and rekeying locks on foreign model cars (which are quite different from domestic cars), installing and maintaining master keying systems, and installing and repairing electronic burglar and fire alarm systems. Individuals who work with the electronic systems may be called protective-signal repairers (U.S. Department of Labor 1978).

> Hiqh security work is often done for major corporations, government institutions, large banks, racetracks, museums, and wealthy private individuals who desire maximum security. Often work involves access control systems using card readers or voice print equipment, possibly combined with electronic push-button locks that work off a combination of numbers known only to a few individuals. ("Locksmiths" 1980)

Established locksmiths who work out of their own home and use a van as a mobile workshop can gross $40,000 to $50,000 per year ("Locksmiths" 1980) (Reed 1980).

Hours and working conditions can vary greatly. If people are locked out of their car at two a.m. they may need a locksmith right then, whether there is a foot of snow on the ground or not. Installing and repairing electronic burglar systems would probably fit into more established business hours most of the time.

Locksmiths need to have "mechanical aptitude, good hand-eye coordination, and manual dexterity. A neat appearance and a friendly, tactful manner are also important, since the locksmith has frequent contact with the public" (U.S. Department of Labor 1977, p.429-431). Those working with security systems need a basic understanding of electricity and electronics.

Education and Training Requirements

Many locksmiths learn their trade through on-the-job training. However, it is becoming more and more time consuming and costly for an employer to provide training. Today, these employers are turning to residential and correspondence schools to train their new employees. This gives an employer an ablebodied apprentice, instead of someone completely ignorant of the trade who might tend to make costly mistakes because of lack of confidence and training. Even when people have graduated from a locksmithing program, the on-the-job experience is still an important part of their education ("Locksmithing" 1980) (U.S. Department of Labor 1978) (Treuman 1980).

Additional coursework and experience is necessary to work with electronic protective systems. The New York School of Locksmithing's "Electronic Security" course is 300 hours in length. It covers the following subjects:

1. Introduction to electronic security (5 hours)
2. Basic Electricity (10 hours)
3. Volt/ohm meter (5 hours)
4. Mercury, contact, and button switches, etc. (10 hours)
5. Control box wiring (15 hours)
6. Installation of casement-type windows (10 hours)
7. Wire used to protect skylights, doors, and other areas (5 hours)
8. Installation of stranded and trap wire, windows and doors (5 hours)
9. Handling wire (5 hours)
10. Installing spring contacts (10 hours)
11. Installation of micro switches (15 hours)

12. Installation of pulsed modulated equipment (5 hours)

13. Bells and other warning devices (10 hours)

14. Bell batteries (10 hours)

15. Second relay in a two bell system (20 hours)

16. Electronic space protection (20 hours)

17. Vehicle and marine alarms (10 hours)

18. Servicing and burglar alarm system (25 hours)

19. Floor plans (10 hours)

20. Fire and smoke alarms (20 hours)

21. Property protection (10 hours)

22. Determining components to protect a supermarket (5 hours)

23. Putting it all together (8 hours)

24. Wireless burglar/fire alarm system (5 hours)

25. Electronic dialers (10 hours)

26. Business practices, tricks of the trade, estimating, making contracts (32 hours)

27. Review and evaluation (5 hours)

(New York School of Locksmithing 1980)

Employment Outlook

The U.S. Department of Labor projects employment growth to be faster than average for the relatively small locksmithing occupation.

> Opportunities will be particularly favorable for locksmiths who know how to install and service electronic security systems. Use of such systems has expanded greatly in recent years, and still greater growth is expected in the future. (U.S. Department of Labor 1978)

As depicted by Entrepreneur Magazine, "These are boom times for locksmiths across the country, making locksmithing one of the fastest-growing service businesses around" ("Locksmiths" 1980).

Employment Setting

Traditionally, the average locksmith shop has been a dingy little place usually consisting of a man and his wife or a man and his son. Today, locksmith shops are becoming large establishments with many employees, both inside and on the road in cars or trucks, offering complete lines of locking devices and alarm equipment. In addition, large institutions and corporations see the need for their own security technicians, and this has opened up a whole new area in the job market.

Customarily, recruitment for locksmiths has taken place through the usual means of classified advertising. However, in those areas where schools are located, employers often make use of placement services for the graduates (Treuman 1980).

Career Advancement Opportunities

An employed locksmith can advance to a supervisory position in a larger locksmith shop. Many locksmiths open their own businesses and are self-employed. Protective signal repairers in electronic security business can follow a similar pattern--advance to a supervision capacity or open their own firm; although, a firm specializing in electronic security systems would probably be more difficult to establish than a regular locksmith shop.

Available Curriculum and Programs

Most formalized locksmith preparation that is currently available is provided by private trade schools or through correspondence schools. In a recent article on initiating locksmithing businesses, fourteen schools were cited nationally as offering training in how to be a locksmith ("Locksmiths" 1980).

Another source of preparation or upgrading is The Associated Locksmiths of America, Inc., a trade organization which offers courses at its annual convention.

Implications for Curriculum Development

Education and curriculum for locksmithing appears to be available, but not highly accessible. As the need for security increases the need for two-year technical colleges to offer locksmithing programs will increase also (Anderson 1980).

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Speech-Language and Hearing Assistant

Speech-language pathology involves working with "children and adults who have speech, language, and voice disorders resulting from causes such as the total or partial hearing loss, brain injury, cleft palate, mental retardation, emotional problems, or foreign dialect Individuals with articulatory difficulty, stuttering, and deviant language development are also diagnosed and treated by the speech-language pathologist. Audiology involves the assessment and treatment of hearing problems. These two areas are often interconnected and may require joint competencies on the part of personnel (U.S. Department of Labor 1978). Speech-language and hearing assistants or communication assistants, assist speech-language pathologists and audiologists in their provision of services to clients.

Functions, Duties, and Specifications

"The specific role of the speech-language assistant and audiology assistant will be influenced by the particular needs of the clinical speech, language and/or hearing program, and must be determined by the professional who will be responsible for training and directing the assistant" (American Speech-Language-Hearing Association 1980).* Therefore, a paraprofessional in the public schools who helps children learn to articulate better will have very different activities from the assistant in a rehabilitation center who works with injured veterans who have lost their hearing.

Assistants "may engage only in those duties that are planned, designed, and supervised by the professional" (American Speech-Language-Hearing Association 1980). Examples of possible duties follow:

1. Screen speech, language, and/or hearing.

2. Conduct evaluative or management programs and procedures that are:

    a. planned and designed by the professional

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* This statement, and others attributed to the American Speech-Language-Hearing Association (1980), are based on a set of draft guidelines for employment and utilization of supportive personnel in audiology and speech-language pathology. These guidelines do not currently constitute recognized Association policy, but rather are being processed through channels to receive such approval and are, therefore, subject to change.

b. included in published materials which have directions for administration and scoring and for which the assistant has received training.

3. Record, chart, graph or otherwise display data relative to client performance.

4. Maintain clinical records.

5. Report changes in client performance to the professional having responsibility for that client.

6. Prepare clinical materials, including ear molds.

7. Test hearing to determine if it meets published specifications.

8. Participate with the professional in research projects, inservice training, public relations programs, or similar activities.

The assistant may not engage in any of the following activities:

1. Interpret obtained observations or data into diagnostic statements of clinical management strategies or procedures.

2. Determine case selection.

3. Transmit clinical information (including data or impressions relative to client performance, behavior, or progress) either verbally or in writing to anyone other than the professional.

4. Independently compose clinical reports, except for progress notes to be held in the client's file.

5. Refer a client to other professionals or other agencies.

6. Use any title either verbally or in writing other than that determined by the professional (American Speech-Language-Hearing Association 1980)

The federal government specifies the following characteristics as desirable for health aides and technicians (in which category speech-language and hearing assistants are placed):

1. Knowledge of specific scientific techniques and procedures involved in the given work situation

2. Attention to details

3. Dexterity

4. Reasoning ability

5. Organizing ability in performing examinations or treatments in an orderly and systematic fashion

6. Accuracy of work in performing examinations or treatments and in reading and reporting findings

7. Ability to get along with professional and paramedical personnel in the hospital or clinic

8. Sensitivity to patients and their needs

9. Ability to gain cooperation of the patients "(U.S. Civil Service Commission 1968)

For the speech-language assistant and the hearing assistant, some of the above characteristics, e.g., accuracy of work (#6), are more important than others e.g., dexterity (#3). Moreover, the assistant may need to possess other characteristics which are not listed, e.g., adequate communication skills for the tasks assigned.

Education and Training

Very few formal training programs exist for speech-language and hearing assistants. A high school diploma is currently considered a minimum requirement for employment. Competency-based instruction is the preferred mode of training by the American Speech-Language-Hearing Association.

Appropriate areas for training may include any or all of the following:

1. Normal processes in speech, language, and hearing

2. Disorders of speech, language, and hearing

3. Behavior management skills

4. Response discrimination skills including but not limited to the discrimination of correct/incorrect verbal responses along the dimensions of speech sound production, voice parameters, fluency, syntax and semantics

5. Program administration skills including stimulus presentation and consequation, data collection and

reporting procedures and utilization of programmed instructional materials

6 Equipment and materials used in the assessment and/or management of speech, language, and hearing disorders

7. Overview of professional ethics and their application to the assistant's activities. (American Speech-Language-Hearing Association 1980)

An example of some of the competency-based objectives for training of speech-language paraprofessionals in the Columbus, Ohio schools are as follows:

1. The paraprofessional will demonstrate an understanding of the steps in speech correction specifically with /s/, /z/, /r/, /th/ phonemes.

2. The paraprofessional will be able to compile a threapy schedule for all children in their program.

3. The paraprofessional will be able to understand and administer the Swirl-R-Pack. ("Training Module" n.d.)

Obviously these examples are quite specific to the setting of schools. Similar types of objectives are needed for training assistants according to the requirements of other employment sites. Some employers might use assistants in a more interdisciplinary fashion, in which case their training would also need to reflect knowledge in other subject areas. For example, in treating mentally retarded persons who live in institutions a team of professionals (psychologist, speech language pathologist, M.D., and physical therapist) might work together. They would have need of an assistant who could assist all of them in their various activities. This assistant's expertise would have to be broader than the area of speech-language and hearing alone (Tull 1980).

Employment Outlook

The employment of speech-language pathologists and audiologists is expanding for several reasons:

1. Public Law 94-142, passed in 1975, requires free appropriate public education for all handicapped children.

2. Population growth and the increasing proportion of older persons (who may have hearing and other com-

munication difficulties) means there are more people who may need services.

3. Recent coverage by Medicare and Medicaid of additional speech-language and hearing services will allow more people to purchase services.

4. Heightened interest on the part of the public in speech-language and hearing disorders and treatment will facilitate early recognition.

5. Research and the creation of new knowledge about problems of persons with speech-language and hearing disorders and potential treatments may increase applicability of services to previously unserved persons. (American Speech-Language-Hearing Association 1980) (U.S. Department of Labor 1978)

The Bureau of Labor Statistics projects that speech-language pathologists' and audiologists' employment prospects are "expected to increase much faster than the average." Estimated 1978 employment was 32,000, with an average of 3,900 average annual openings projected between 1978 and 1990 (Nardone 1980).

Growth of employment at the professional level and the increasing use of paraprofessionals and technicians in most of the medical and human service areas are projected. One can conclude that the use of communication aides will increase also, as more speech-language pathologists and audiologists are available to provide requisite supervision.

Employment Settings

Speech-language pathologists and audiologists and their assistants are employed in a range of work settings. These include: schools, mental retardation service agencies (both institutional and community-based), speech-language and hearing clinics, rehabilitations centers, universities (teaching, research, and clinical practice), industry, hospitals and private practice (Tull 1980).

Career Advancement Opportunities

Career advancement opportunities for speech-language and hearing assistants would be limited unless they were interested in obtaining further professional education and credentials. Because their work must be so closely monitored by the professional with whom they work and because no job level between the two exists, it appears there would be little chance for assistants to move into supervisory roles.

Available Curriculum and Programs

Very little curriculum designed to prepare communication assistants was located through a search of the literature. One training manual which was reported is no longer available by the publishing source. On the job training curricula have been developed by some individual employers ("Training Module" n.d.). In addition, some community colleges are attempting to provide in-service training for employers of communication assistants and mental retardation aides (Tull 1980). These programs may or may not be available to regular students on an ongoing basis, depending upon the school. Many community colleges and technical schools do offer courses in the more general human services and health technologies. Some of the curricula from these programs would be applicable to the preparation of speech-language and hearing assistants in developing characteristics similar to those described earlier for health aides and technicians.

Implications for Curriculum Development

There appears to be a need for a general, competency-based curriculum for the preparation of speech-language and hearing assistants. Upon completion of such a curriculum, the assistants would then need on-the-job training appropriate to the specific site and tasks on which they would be working.

Since a high school diploma is currently considered an adequate credential for employment, in conjunction with appropriate personal characteristics and abilities; a secondary level curriculum might be well sutied for this area. Or, a one-year certificate program at the postsecondary level might be an effective means of preparing speech-language and hearing assistants. However, with the increasing attention being paid to educating the handicapped, serving the mentally retarded, and assisting the elderly, one can expect the need for speech-language and hearing assistants to grow. Thus, the need for a curriculum to prepare these assistants will grow.

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Word Processing Specialist

Word processing is a method of producing written communications at top speed with greatest accuracy, the least effort, and the lowest possible cost--through the combined use of proper procedures, automated business equipment and trained personnel (Taylor 1980). The term, word processing, was created by International Business Machines (IBM) in the 1960s "to describe the processing of paperwork using dictating/transcribing machines and/or typewriters, especially automatic typewriters and text-editing equipment" (Frerichs 1977). The primary differences between word processing and earlier office procedures are:

1. the use of dictation/transcribing equipment, rather than manual shorthand,

2. the elimination of "one boss-one secretary" as an office model, and

3. the placement of secretarial positions in a controlled, supervised environment. (Kidwell 1977) (Taylor 1980)

The reason for using the new word processing procedures and equipment is that productivity can be increased. (Tilton 1978) (Hulbert 1977) (Casady 1980). However, this more efficient way of producing documents, letters, and other text materials requires some new and more highly refined skills of from the secretaries involved in word processing. The curriculum for preparing clerical employees must also change in order to adapt to the different work environment.

Functions, Duties, and Specifications

Clerical staff working with word processing equipment may have the job of word processing specialist, word processing technician, correspondence secretary, or operator (Day 1977). The job prerequisites are slightly modified from traditional clerical requirements.

> The individual seeking employment in the field of word processing must be able to accept sitting and concentrating for long periods of time. The job requires manual dexterity, manipulative skills, and vision adequate to see the copy from which you are typing, as well as the CRT screen. There must be neurological capacity to memorize symbols and to follow written and oral instructions. Mechanical reasoning and the ability to transfer skills to other machines are important, along with a capacity

> to stress accuracy and preciseness. The librarian qualities of filing, remembering, and accessing are also requisite. (Orange County Department of Education 1979)

Communication skills are essential to the word processing specialist. He or she must be able to exchange information, both orally and in writing, with peers, supervisors, and the originators of the written documents. Keyboarding capabilities are necessary also. The requirements for one large insurance company are sixty words a minute with no more than three errors (Taylor 1980).

According to information provided by IBM, a word processing specialist:

> Types from transcribing equipment, handwritten copy, and printed materials. Records documents on magnetic media. Possesses an indepth knowledge of basic magnetic keyboard operation. Makes decisions on how to best utilize equipment for completing work. Communicates with supervisors, originators of documents, and administrative secretaries on completed work. Establishes work priorities. Possesses knowledge of grammar, punctuation, and spelling. Proofreads all materials. Assists in receiving, logging, and distributing incoming work to the center. (Day 1977)

Since secretaries have always had responsibilities for more areas than typing, a number of tasks still remain to be accomplished by someone other than the word processing specialist. The individual who does these tasks ("receiving visitors, placing and receiving phone calls and messages, duplicating and collating materials. . . making travel arrangements," etc.) is often entitled "administrative secretary" (Day 1977).

The hours and benefits for word processing specialists are very similar to those in other secretarial positions. One difference is that a more structured career path exists for word processing staff, so that there is a potential for higher pay. Advancement is more often based on individual merit, rather than on the merit of the boss (a usual situation with secretaries). Hours can be different too, in the case of word processing specialists who work the "night shift" (Frerichs 1977) (Taylor 1980).

Education and Training

One controversial aspect of education for the preparation of word processors is whether or not it is necessary to have "hands on" experience with word processing equipment

(Wright 1980). Word processing equipment is expensive, soon outdated, and quite variable. The equipment one trains on may not be the equipment in use by one's eventual employer. Because of these factors, some persons feel that on-the-job training is the only practical means of teaching people about word processing (after they have attained mastery of the basic office skills). More and more office education professionals, however, are advocating formal, preemployment education with equipment usage if possible, but even without, if necessary (Casady 1980) (Moody and Matthews 1977) (Collins 1977) (Addams and Baker 1977). According to many, the training appropriate for traditional secretaries is also appropriate for word processing specialists, except that a modified curriculum is needed. This need for a modified curriculum is applicable at both the secondary and postsecondary levels of education.

Word processing curriculum must include an emphasis on basic skills and the secretarial skills that are normally taught. Special attention must be given to integrating the following areas into the regular curriculum:

1. Word processing vocabulary and equipment acquaintance --integrate in all business courses plus bulletin board displays and special projects.

2. Communication skills --teach in English, business communication, typing, shorthand, and transcription courses. Along with continued attention on effective writing skills, increased emphasis should be given to oral communication and to machine dictation.

3. Career opportunities --discuss in typewriting, shorthand, and office practice courses. Attention should be given to the entire array of word processing job opportunities, including supervision.

4. Machine inputting --teach in typewriting, transcription, and office practice classes. Emphasis should be given to typing at rough draft speeds and to simulating magnetic keyboarding and backspacing and striking over errors.

5. Machine transcription --given instructions in transcription and office practices classes. In addition to in-class word processing activities, field trips and

cooperative education experiences should be a part of a business program whenever possible. (Addams and Baker 1977)

Employment Outlook

Use of word processing, both the equipment and as a systematic procedure for moving information, is growing rapidly. In fact, the industry is expanding at a 30 percent annual growth rate (International Word Processing Association 1979). The International Data Corporation estimates "that all word processing markets will grow impressively over the next five years; in fact the early 1980s could see an instaffed base of three-quarters of a million word processing keyboards in the U.S. alone" (Rosen 1979). A nationwide survey found that 30 percent of companies with more than 100 employees made use of word processing equipment (Hulbert 1977). An estimated 280,000 word processing systems were installed in businesses with a range of sizes, according to a 1980 article (Menkhaus 1980).

There are some problems associated with the widespread adoption of word processing. User fear of new equipment and/or inefficient use of new, expensive equipment can negate any potential cost savings. Another difficulty with implementation is that word processing specialists may "think the system's structure too rigid, the work repetitive and boring, and the pressure to meet production schedules excessive" (Hulbert 1977). Because word processing specialists do not perform the administrative functions of other secretaries, they may feel a loss in status. These types of internal, user-oriented difficulties can purposely or inadvertently sabotage a word processing system.

However, in general, it appears word processing will come to be synonymous with the term "office of the future" and will be adopted on a massive scale. The need for trained personnel is now and will continue in the future to be substantial.

Employment Settings

Word processing specialists will be employed in all types of offices in all types of industry settings. The larger offices with heavy paper work tend to adopt word processing first.

Career Advancement Opportunities

New career paths have been created as a result of implementation of word processing procedures in office work (Day 1977). Individuals can attain entry level positions in either a word processing or administrative secretary capacity and advance through several levels of responsibility.

They can become proofreaders, word processing analysts, supervisors of word processing specialists, and executive secretaries, or ultimately managers of all word processing operations within a company (Day 1977).

Available Curriculum and Programs

Arnold Rosen, the 1979-80 president-elect of the International Word Processing Association, has developed prototype curricula for word processing. The outlines for an introductory course, a one-year certificate program, and a two-year program are provided in tables 3.1, 3.2, and 3.3 (Rosen 1977-78). Rosen himself states though, that there is a tremendous need for curriculum development in this field (Rosen 1980).

Two particularly good documents which discuss word processing curricula (the need, subjects for inclusion, possible formats, and additional references) are:

1. Resource Guide for Performance-Based Word Processing Instruction, by Gerald Day;

2. The Reference Guide to Word Processing Education, from the International Word Processing Association.

Implications for Curriculum Development

Curriculum outlines, materials, and resources are available in word processing. The International Word Processing Association offers help and materials to schools and colleges attempting to design curriculum. However, implementation is not widespread at this time. Schools and colleges seem to need assistance in redesigning their programs to be more responsive to industries' needs.

Another requisite is that dictation skills need to be taught in many additional career fields to maximize productivity and efficient use of word processing capabilities. Also, as future technology developments further expand the benefits of word processing schools and colleges will need to further modify their curricula. These types of technological developments have been projected to occur (Taylor 1980).

FIGURE 3.1

PROTOTYPE OF A TWO-YEAR WP CURRICULUM

Course	Credits
First Semester	
Fundamentals of Typing*	2
Composition I	3
Introcution to Business	3
Health	3
Physical Education I	1
Secretarial Accounting	3
	15
Second Semester	
Intermediate Typing*	
Speech or English	3
Data Processing	3
Word Processing Concepts	3
Science	4
Physical Education II	1
	16
Third Semester	
Machine Transcription I	3
Advanced Typing I	2
Business Communications	3
Business Math	3
Social Science	3
Office Management	3
	17
Fourth Semester	
Machine Transcription II	3
Advanced Typing II (Magnetic Media Operation)	2
Social Science	3
Humanities	3
Work Processing Workshop	3
Word Processing Field Work	3
	17
TOTAL CREDITS 65	

FIGURE 3.2

PROTOTYPE OF A ONE-YEAR WP CERTIFICATE PROGRAM

Course	Credits
First Semester	
Typing II*	2
Business Communications	3
Introduction to Business	3
English	3
Word Processing Concepts	3
Business Math	3
	17
Second Semester	
Typing III*	2
Data Processing	3
Administrative Management	3
Machine Transcription	3
Word Processing Workshop	3
Elective	3
	17
TOTAL CREDITS 34	

*Students may be placed in advanced typing class based on previous typing experience.

Source: Rosen, Arnold, "Models for WP Curricula". Words. Willow Grove, PA: International Word Processing Association, Winter 1977-78, 37-39.

FIGURE 3.3

INTRODUCTION TO WORD PROCESSING

Course Outline

1. Introduction
   - A. History
   - B. Definitions
2. Current Office Practices
   - A. Impact of White-Collar Labor Force
   - B. Costs of Paperwork and Salaries
3. Feasibility of Word Processing
   - A. Initiating a Feasibility Study
   - B. Analyzing Typing and Administrative Functions
   - C. Forms for Word Processing Systems Study
4. Organization & Structure of a Word Processing Installation
   - A. Place of WP in Organizational Structure
   - B. Policies and Procedures in a WP Center
5. Equipment
   - A. Selection
   - B. Evaluation
   - C. Comparative Analysis
6. Input
   - A. Input Equipment
   - B. Dictation Procedures
   - C. Dictators and Secretarial Responsibilities
7. Output
   - A. Output Equipment
   - B. Types of Documents suitable for a WP Center.
   - C. Applications
8. Case Studies of Word Processing Systems in Various Types of Firms
   (Includes Field Trips, Attendance at WP Conventions, and Guest Speakers)
9. Records Management
   - A. WP and Micrographics: Paperless Information System
10. Reprographics
    - A. Copying and Cost Control; Duplicating and Cost Control
    - B. Selecting the Right Equipment; Centralized vs. Decentralized
11. Personnel
    - A. The New Role of the Secretary; New Job Titles
    - B. Selection, Training, Orientation, and Promotion
    - C. The Position of WP Manager
12. Psychological Implications
    - A. Overcoming Resistance to Change
    - B. Adapting to WP; Emphasizing Positive Aspects
    - C. Services to Users
13. The WP Center
    - A. Concept of Open Landscape Planning
    - B. Environmental Factors-Lighting, Heating, and Ventilation
    - C. Furniture and Furnishings
14. Measurement and Control
    - A. Establishing Work Standards
    - B. Measuring Employee Performance
    - C. Guidelines for Cost Control
    - D. Preparing a WP Procedure Manual
15. Administrative Support Concepts
    - A. The Role of the Administrative Secretary
16. Word Processing of the Future
    - A. Projections for Occupational Careers, Equipment Technologies
    - B. Meeting the Information Needs of the Next Decade
    - C. Future Applications in Business and Education

Source: Rosen, Arnold. "Models for WP Curricula". Words. Willow Grove, PA: International Word Processing Association, Winter 1977-78, 37-39.

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Modified Descriptions of New Occupations and Their Curriculum Development Needs

Fiber Optics Technician

Perfusionist

Fiber Optics Technician

Fiber optics, or optical fibers, are gossamer filaments which are revolutionizing the communications and information processing industries. This new technological development allows messages to be carried via infrared light along a glass tube which is less than thiry-nine millionths of an inch in diameter. Previously, bulky copper cables had to be used, which were more difficult to install and repair and took much, much more space (Boraiko 1979).

Some of the uses of fiber optics include:

- o inspection tools, which can "look" into complex machinery and equipment to diagnose working problems, and which eliminate the need to disassemble the entire piece of equipment,
- o night vision goggles that intensify the available light so people with night blindness or helicopter pilots, for example, can see after dark,
- o connections between computers around the world,
- o increased capacity of telephone lines,
- o endoscopes, which are diagnostic flexible tubes which can be inserted within human openings (mouth, nose, or rectum) to view the inside of the body in looking for abnormalities requiring medical attention,
- o crosswalk signals that are brighter than usual and consume less energy. (Boraiko 1980)

As more uses of fiber optics are realized and the current uses gain wider acceptance, the occupational implications will become more obvious. For example, technicians who can operate the new equipment made possible by fiber optics (endoscopes, industrial equipment inspection tools) will be needed as the implementation of this equipment becomes common. Other uses, not yet invented, may also require new skills.

The actual manufacture and installation of optical fibers does not necessarily require new personnel. People who have been working in the glass-type industries or with copper cables will now be working with a new medium. Upgrading of skills may take place at the work site, but new two-year programs at the postsecondary level are not seen as needed at this time (Kao 1980).

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Allen Boraiko
National Geographic Society
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Charles Kao
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Perfusionist

"The responsibilities of the perfusion technologist include the operation of equipment supporting the patient undergoing open-heart surgery, specifically the heart-lung bypass machine" ("School of Perfusion Technology" n.d.). This equipment regulates the oxygen, carbon dioxide, and blood chemistry and circulation during surgery or in cases of respiratory failure. The perfusionist must know how to operate the equipment and be able to make adaptations quickly, as the surgeon goes onto another step or begins an alternate procedure.

Other job titles by which perfusionists may be known are: "cardiovascular perfusionist, clinical perfusionist, extracorporeal technologist and perfusion technologist" (Kennedy 1979). It is important that perfusionsists not be confused with cardiopulmonary technologists or technicians. Cardiopulmonary technologists, "directed by a physician, conduct diagnostic testing procedures for the evaluation of heart and lung functions and for the detection of heart and lung diseases." (National Society for Cardiopulmonary Technology n.d.).

There are thirteen schools nationally which prepare persons to become perfusionists that are accredited by the American Board of Cardiovascular Perfusion. Competition for admission to these programs is high. The programs take one or two years to complete, and entrance requirements often include previous medical training or experience.

In 1979, an estimated two to three thousand persons worked as perfusionists. The demand for perfusionists will grow according to the number of open-heart surgeries that are performed. Average starting pay for perfusionists according to a 1978 survey was $12,500 annually, with experienced perfusionists receiving $16,100 annually (Kennedy 1979).

Curriculum for preparing perfusionists has been developed, as is evidenced by thirteen schools offering programs, although the occupation itself is quite new and is still undergoing a standardization process (Byrd 1979).

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1979 and 1980 Interviews

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Modified Descriptions of Changing and/or Growing Occupations and Their Curriculum Development Needs

Aviation Maintenance Technician

Elecromyography Technician

Hydroponic Agriculture Specialist

Instrumentation Technician

Personnel and Labor Relations Specialist

Welder

Aviation Maintenance Technician

The demand for airframe and power plant mechanics increases as air travel increases and as the technicians who were trained through the armed services during World War II near retirement age. The occupation of aviation maintenance technician itself is not new, however.

The Federal Aviation Administration (FAA) determines curriculum standards for training of aviation mechanics. Some instructors with whom the author consulted felt that parts of the curriclum as it is currently mandated are outdated. Curriculum revision may be needed to maintain "the sophisticated systems of modern aircraft" (Allen 1970). A great deal of military curriculum is applicable to adoption or adaptation by civilian vocational technical schools or colleges.

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Allen, David. A National Study of the Aviation Mechanics Occupation. Los Angeles, CA: University of California, 1970.

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Electromyography Technician

Electromyography (EMG) and electrodiagnosis involve the use of a biomedical instrument which simultaneously makes visual and sound recordings of electric waves associated with skeletal muscle activity. The recording is used in the diagnosis of neuromuscular disorders.

EMG technicians always work under the direct supervision of a physician. They perform a number of tasks associated with obtaining an EMG recording as long as "they do not decide what is to be done, and do not interpret data" ("Responsi- ibilities of an EMG Technician" n.d.). Electromyography techni- cians help: prepare patients, record basic information, administer medication, prepare the limbs for study, place electrodes on the body, help the doctor conduct the needle examination, maintain and operate the electromyography equipment, and perform clerical tasks as necessary.

Salary for electromyographic technologists is approximately $14,000 to $20,000 annually, dependent upon training and experience. Training is typically obtained on-the-job but previous coursework in such areas as physiology, anatomy and laboratory environment is helpful. No formalized training programs appear to exist currently. There are approximately fifty projected job openings nationally per year at the present time (De Luca 1980).

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Hydroponic Agriculture Specialist

Hydroponic agriculture is the growing of plants in nutrient solutions with or without sand, gravel, or other inert medium to provide mechanical support. According to the Encyclopedia Britannica, "the main advantage of gravel culture is in the labor saved by automatic watering and fertilizing, though installation costs are higher. Commercial acceptance of hydroponics is impeded by high installation costs, the necessity for frequent testing of the solutions and the greater familiarity of plant cultivators with soil" (Encyclopedia Britannica 1973).

In the 1960s and 1970s greenhouse production, which can make use of hydroponics, diminished. Vegetables came more often to be transported from Southern and Far Western states to supply Northern and Midwestern fruit and vegetable consumers during winter months. As energy and transportation costs have begun to rise, the feasibility of greenhouse production, and with it hydroponics, rises also (Wilcox 1980).

Use of hydroponics in areas where food cannot otherwise be raised may well outweigh possible expense factors, as in deserts or other regions of poor soil or inadequate rainfall (Jeffery 1980).

Hydroponics is not a new form of agriculture, but if commercial applicability grows, the demand for hydroponics expertise will increase. Anyone can buy a "how to" book about hydroponics and grow their own plants in a nutrient solution; however, at the present time there are only a few companies in the country which market hydroponics systems. These companies provide training to the purchasers of their systems. One company spokesperson projects that the need for specialized greenhouse managers will be evident in just a few years. He added that he knew of no curriculum or training that was available (Jeffrey 1980).

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Wilcox, Gerald E. "Commercial Hydroponics--A New Look at the Technology, Economics, and Future," unpublished paper (authors address is below).

SOURCES
1980 Interviews

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Instrumentation Technician

The occupation of instrumentation technician is not a new one; however, the field is growing and demand for qualified applicants is high. Instrumentation technicians work with the creation, construction, and maintenance of control and measuring devices, and systems for manufacturing and research organizations. They also install, repair, and adjust precision instruments (U.S. Department of Labor 1978). "The variables that are measured and controlled include temperature, pressure flow, liquid level, velocity, density and many others" (Instrument Society of America n.d.).

Instrumentation technology is important in the following types of industries:

1. Aeronautical/Aerospace
2. Biological
3. Chemical
4. Electronics
5. Food
6. Glass and Ceramics
7. Instrument and Controls Manufacturing
8. Iron and Steel
9. Medical
10. Nuclear
11. Oceanography
12. Petrochemical
13. Petroleum
14 Public Utilities
15. Pulp and Paper
16. Transportation

(Instrument Society of America n.d.)

Two-year programs offering instrumentation courses exist in approximately 200 schools nationally. According to Dr. James Hamlin of the Instrument Society of America, these general instrumentation curricula are quite adequate. However, curricula are inadequate in a number of the sub-specialties, such as aerospace instrumentation.

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SOURCES
1980 Interviews

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Personnel and Labor Relations Specialist

The demand for personnel and labor relations specialists is growing. "Employment is expected to grow faster than average as new standards for employment practices in areas of occupational safety and health, equal employment opportunity, and pensions stimulate demand" (Nardone 1980). Usually, a four-year business related degree is critical for entrance into the personnel field. Often, promotion from within an organization is accepted practice with personnel jobs.

Up to this point in time, few persons with a two-year associate degree could expect to find a professional or technical level position in personnel (not including clerical or computer-related or other "support" personnel positions) (Pond n.d.). However, specialization of tasks within personnel is coming into being more and more. That is, there may be a Director of Human Resources who supervises a Coordinator of Training and a Coordinator of Personnel. Reporting to the Coordinator of Personnel one might find an Equal Employment Opportunities Specialist, a Payroll Specialist and a Benefits Specialist. In the future these "specialist" positions in larger organizations might be filled by associate-degree people if appropriate curricula were available within their educational programs.

This possibility expresses a controversial view, however, because most people agree that personnel relations requires a high level of expertise and skill. Therefore, only if increasing specialization for given tasks continues to develop, will people with less than a four-year degree have a chance at these personnel positions.

Staff of Arapahoe Community College in Denver, Colorado have surveyed businesses in their local area and concluded that there is sufficient demand to develop an associate level personnel program. Subjects to be included in the curriculum include the following:

1. The history of personnel management
2. The transition from personnel management to industrial relations
3. The functional organization (staff, line or a combination thereof)
4. The organization and its relationship to upper management
5. The organization and its relationship to the line organization

6. The recruiting and selection function

7. Testing (employment requirement)

8. Labor relations (from contract negotiation to arbitration)

9. Wage and salary administration (hourly and salaried)

10. Personnel policies and procedures

11. Federal and state regulations (progressive history)

12. Physical requirements (original hiring requirements and continuous job specification requirements)

13. Performance evaluations

14. Promotions, layoffs, discharges

15. The "Talent Book"

16. The organization and society

17. Substance abuse problems and government regulations

18. Minorities and females

19. Handicapped personnel

20. Safety (OSHA) requirements

21. The organization and the worker

22. Counseling (both hourly and salaried)

23. Training (production and executive personnel)

24. Fringe benefits

25. Bonus programs, profit sharing and stock options

26. Employee fringe benefits other than union benefits

27. Organization functions in federal and state governments

28. Employee benefits by government decree (workman's compensation, etc.)

29. Organizational membership in societies (Shelhimer 1980)

One specialized position, that of Compensation Analyst, was found in a survey reported in a 1979 issue of Personnel Journal to be held by persons with less than a four degree 84 percent of the time (Langer 1979).

Curriculum for preparing personnel and labor relations professionals is available at the four-year level, but would have to be adapted to be offered at the two-year postsecondary level. This field will need to be observed closely over time to determine if postsecondary education is an appropriate training ground for entrants.

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SOURCES
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Welder

Welding and welders are not new, but they are changing. Many technological developments have taken place recently, especially in areas such as underwater welding or welding of miniature electronic equipment (National Aeronautics and Space Administration 1979). Welding that involves the use of lasers or computers requires additional technical skills of welders.

A critical shortage of welders exists now, and as specialization increases it may become even more acute. The general welding curriculum taught in vocational or technical schools is adequate as far as it goes. However, the director of the education department of the American Welding Society feels that schools and colleges can not afford the expensive equipment required to teach the new technical skills needed in welding (Weir 1980). Perhaps joint offerings by schools and companies could be developed which would facilitate the training of these specialized welders.

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CHAPTER 4

CONCLUSIONS

There are a number of new and changing occupations within the labor market of the United States for which little or no formal curriculum exists. This study attempted to identify and describe such occupations which fall within the realm of vocational/technical education and are in demand throughout the country.

Summary of Results

Some of the occupations identified seem to have no curriculum available. No formal programs to prepare people for these occupations could be located. Some occupations have a need for two or more existing curricula to be combined into one, to be updated, or to have new portions added. There are still other occupations or technologies which are very new, and which need to be observed over a period of time. If certain expection come to pass, and the occupations grow, a need for curriculum to be developed may also grow. On the other hand there are occupations which are quite new that have already undergone extensive standardization in terms of educational preparation requirements. Lastly, several of the occupations which were identified as new or changing appear to have an adequate curriculum, but schools and colleges seem to need help in implementing the curriculum or in initiating new programs.

A listing of each of the occupations that fall into the these categories follows. For a more complete description of why a given occupation has been categorized as it is, see the chapter on results.

- Occupations that need major curriculum development are--

    1. catfish farm manager,
    2. computer drafting/graphics technician, and
    3. speech-language/hearing assistant.

- Occupations that have a partial need for curriculum development, or that need combining or updating of existing curricula are--

    1. cable television technician,
    2. instrumentation technician, and
    3. aviation maintenance technician.

- Occupations that should to be observed over time are--

  1. neurometrics technician,
  2. electromyography technician,
  3. hydroponic agriculture specialist,
  4. fiber optics technician, and
  5. personnel and labor relations specialist.

- Occupations that are new, but which seem to have adequate curricula are--

  1. perfusionist.

- Occupations that may need implementation assistance are--

  1. locksmith,
  2. word processing specialist, and
  3. welder.

The Research Effort as a Whole

For a three year period (1978-80) the National Center has been examining new and changing occupations and assessing the need for curriculum development. This effort was undertaken to inform federal planners in the Office of Vocational and Adult Education about changes in the labor market and the potential implications for vocational education programming. Descriptions of thirty-four occupations and occupational areas have been submitted. Fifteen are within this annual report.

The methodology for undertaking such research has developed throughout the three year period. Contract restraints did not permit the collection of original data on a large scale; however, the means that were used to identify and analyze new and changing occupations needing curriculum development have been effective. The research methodology is adaptable for use at state and local levels also.

This research effort will not continue in 1981, but there is a need for the subject to be revisited periodically, as more changes will occur in the future. Additional changing and arising occupations will become evident within another few years. The assessment of these occupations will be critical to the ongoing quality of vocational education as a preparer of labor force participants.

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